September 1983 $3

PCM™

Vol.I No.3

THE PORTABLE COMPUTING MAGAZINE

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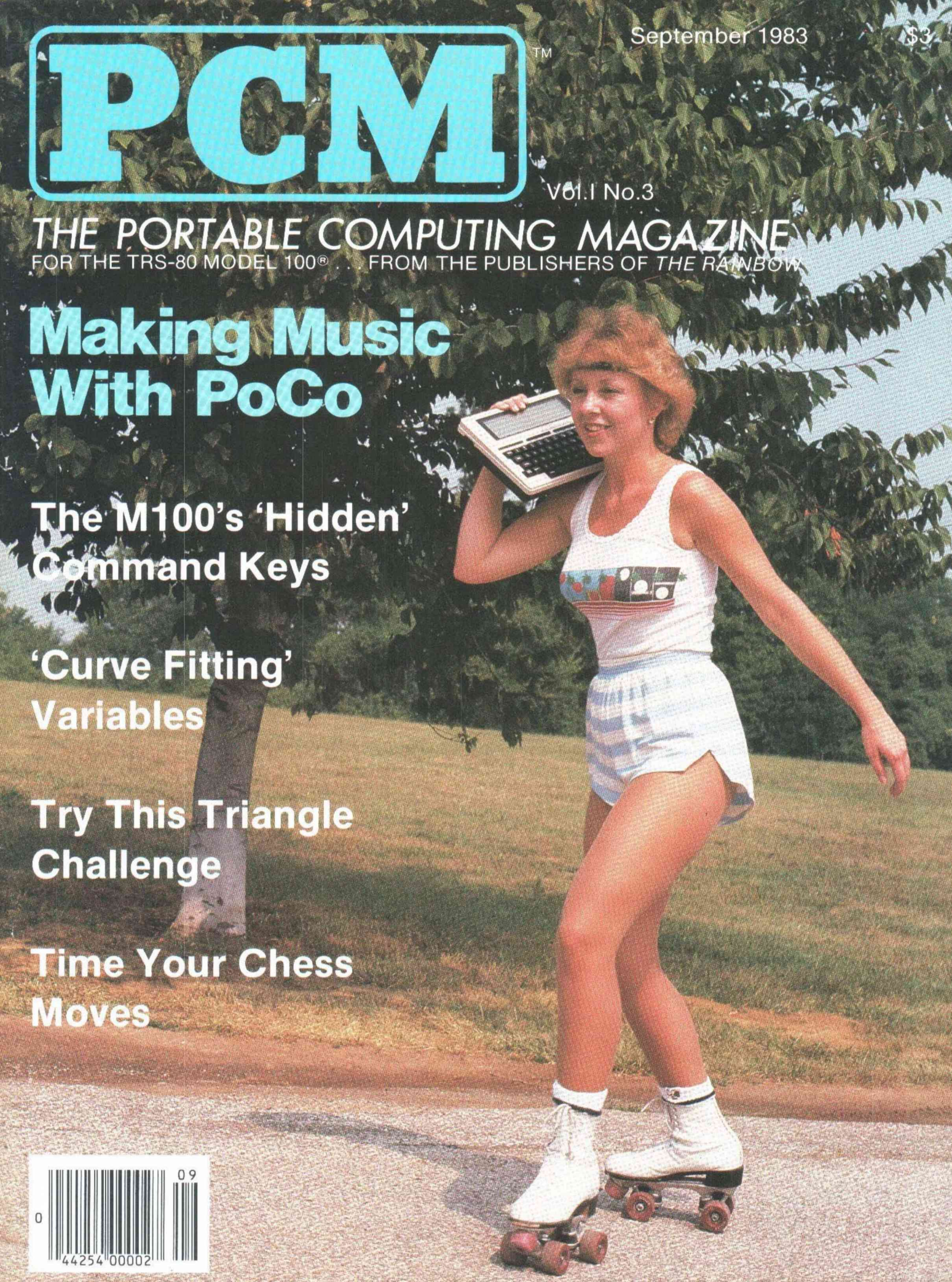

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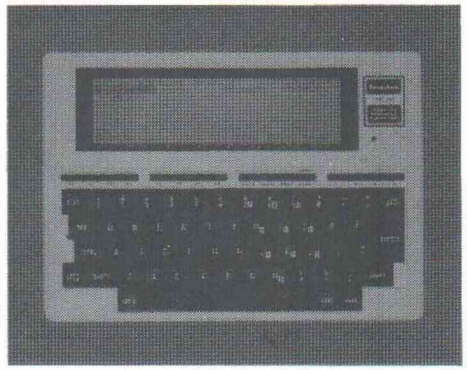

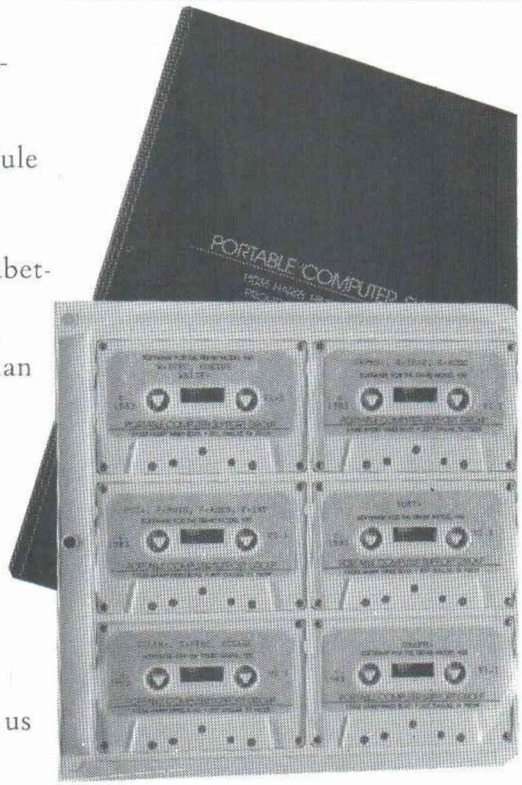

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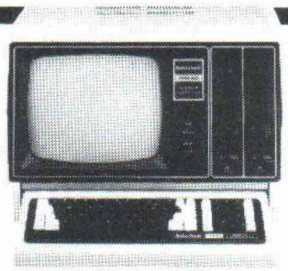

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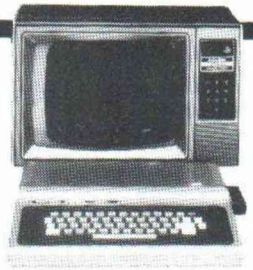

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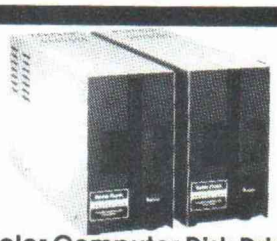

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Wonders of East And West, or Sheik it up, Baby

One of the things which I consider to be among the most fantastic about the Portable Computer is its ability to carry programs with it in its own memory. This, I believe, is a true advance in the world of computing. And, with the built-in programs in the Model 100, I believe what we are pleased to hold in our hands is one of the best applications of computers today.

Well, the truth is that I just don't get out of the office very much. And there is no question that the Portable Computer — while it certainly shines in the office environment — is without peer on the road. (Could that be why we have a column with that name?) So, a couple of weeks ago when I was finally dragged off for some restful vacation, I decided it would be a great opportunity to "field test" the Portable Computer in some far-reaching fields.

I will not try to tell you that the better half of my family thought it was totally peachy-keen to have a computer going along on a vacation. There was some mention of needing to "get away from those things for just *two* weeks." But what an opportunity.

So, as you will see on this page, I am also indulging myself in showing you a "vacation" picture. Yes, that's me, at the bottom of the pyramid of Cheops. And, yes, that's my trusty Portable Computer. We were working a little program to figure the height of equilateral triangles using the pyramid.

As for the hat: It is hot at the pyramids, of course. A friendly camel-driver lent me his sun-bonnet.

Should I digress. Perhaps so.

If you will accept the given that my Portable Computer *was* going on vacation with me, then the only question is why. And the answer is pretty simple. Or, perhaps, the answers.

To get to said pictured pyramid, we had to take a plane, a boat, a bus and, finally (I kid you not) a camel. No, I did not *have* to take the camel, but who could miss a chance like that!

There is no electricity on the plane, the boat had European current only, the bus didn't have any sort of electricity and the camel, well . . . How is a serious computerist going to solve all these problems?

Answer: Batteries and the Portable Computer.

I loaded up a few games from *Silverware Software* into my Portable, stashed it in a tote bag along with a lot of other stuff we didn't want to chance the airlines with, and headed out for New York and, hence, Athens. A royal send-off in New York was arranged by Bob Rosen of *Spectrum Projects*.

I played *Reversi* from New York to Athens. The flight was nine hours. The Portable Computer won a lot more often than did I. Transferred (as they say in the travel business) from the airport to the *T.S.S. Stella Solaris*, I thought I was seeing double. Someone else aboard, a fine gentleman named Angus German of Costa Mesa, Calif., also had a Portable under his arm. My wife winced. So did his. But we played it cool and didn't devote *too* much time to computing (you'll see some of his programs in future issues).

Oh, yes, the pyramids. Two days out of Athens we hit Port Said, Egypt. Trusty Portable Computer and I loaded ourselves onto a bus for a three-and-a-half-hour ride to Cairo and, hence, the pyramids. Near them, I boarded a camel

named — I was told "Yankee Doodle Dandy" (although I expect the name changes with the nationality of the tourist). Anyhow, "Yankee Doodle Dandy," the Portable Computer and I soon arrived at the pyramids.

I sat down and started computing, working a simple program I was taught in high school geometry. The purpose wasn't to really *do* anything at this point so much as "test" the portability of the Portable.

Some camel driver loaned me his hat — the sun *was* hot. Wife Willo snapped the photograph. And the Portable Computer? With all the banging, dirt, dust and heat, it performed beautifully.

I'm sure this whole story, with which you are no doubt bored by now, does illustrate a point quite well. And that is that the Portable Computer is *truly* portable. Whether it is in your car, on a boat, or on a camel — it will go where you need it to and perform as you want it to.

More important, it is all you need. Because I was able to load my little geometry program into memory in the cool confines of my home here in Prospect, Ky., before ever venturing out, there was absolutely no need to take anything else along. I had the material I needed "on site," as they say.
And that, I think, says worlds for the Portable Computer.

On a more mundane subject, we are very gratified here by the acceptance of *PCM — The Portable Computing Magazine*. Many of you have been kind enough to write us to say how much you have enjoyed the first two issues and that you are looking forward to seeing more of them.

Well, naturally, more will be coming in future issues. And, shortly, more will be coming in *each* issue.

The reason for this is that the economics of the magazine business are such that we try to run about half of the magazine with editorial material and the other half with advertising. Thus, as our advertising grows, so will *PCM*. We hope that, within the next several months, *PCM* will double in size.

You can help us do that. The old request to "Please Patronize Our Advertisers" may seem trite, but it *does* help us a lot. And the word spreads among advertisers. So, please do patronize those firms which advertise in *PCM*, and, too, please let them know where you saw their advertisments. It can only help both of us by allowing us to provide a bigger and better magazine.

—Lonnie Falk

Letters

Editor:

Let me congratulate you on a superb publication, *PCM, the Portable Computing Magazine*. I have ordered, received and am using the BUSINESSPAK+ by Portable Computer Support Group. This letter was generated by their *WRITE+* program. Their manual is easy to read, understand and use.

I have ordered *Quick Plot* from Solutions Computer Company, but have not received the program. As soon as I get some usage, I'll let you know the results.

Applause and a bouquet of roses to Robert Frowenfeld for his clear, precise article *Plotting Graphs with the Model 100*. The program works *very, very well.*

I personally thank you for your publication, Mr. Robert Frowenfeld for his excellent article (I hope he contributes informative articles that we, the novices, can use) and the Portable Computer Support Group for their friendliness, consideration, and easy-to-use software.

I am anxiously awaiting the August issue.

Darran N. Huggins, M.D.
Ashland, OH

Editor:

PCM promises to be as great as *the Rainbow!* Congratulations on a fine first issue. My copy arrived the day before I got my PoCo.

Since my "mainframe" is a CoCo, I'd like to see the problem of transferring files from PoCo to CoCo addressed. My files refuse to transfer via cassette. Of course, I can telephone them from one to the other, but I'd like to see cassette files load directly into CoCo.

Also, I hope someone comes up soon with a box that will enable me to use my Epson MX-80 without going into it each time to remove the serial-to-parallel card from the printer.

It isn't often that I can argue with the experts, but contrary to what Bob Rosen says (page 13) I have no trouble flipping from page to page in text mode. All it takes is two SHIFT-up arrows or SHIFT-down arrows on my 24K machine.

I hope Melvin Hefter puts his great expertise to work on some programs for PoCo. His programs for CoCo are among the most useful I have.

Max C. Shank
Chicago, IL

Editor:

I purchased a TRS-80 Model 100 Portable Computer specifically to use as a terminal device from my office during the day and still be able to carry it home at night after work. I happen to work in a public institution and cannot leave an expensive terminal unattended. I also own an Apple computer which I have had for years and I use it at home. The Apple has a serial card installed and I have been able to transfer material back and forth between the two computers using the Telecom at one end and ASCII Express Professional at the Apple end very easily. I use this method for bulk storage of my PoCo data onto Apple floppy disks rather than store stuff on the cassette recorder. I am transferring at 4800 Baud rate which is much faster than cassette, plus I gain the advantage of having a directory on the disk. In fact, one of my major objections to using a cassette for program storage is the lack of a directory. It is almost necessary to use a separate cassette tape for each program. I can't wait until the Shack announces a better bulk storage system for their excellent PoCo.

Larry Boulet
Warren, MI

Editor:

Your "Lprint" (page 5) asks for mail responses, etc. I think the name *PorCo* would be a better name than PoCo. There is CoCo that is in use and it could be confused with that name. Also, the Spanish connotation of words such as poco loco would detract from the significant seriousness of the name.

One of the most important things that your magazine can do would be to develop a translation formula between MicroSoft (which I believe is the Model 100 language) and the BASIC language used by IBM and other PCs.

I am a CPA and don't at all understand the creating of a program but I am self taught enough to be able to load it into the 100. In fact, I did it with the *Biosin* program and obtained great results. By the way, was there a typographical error on page 12, line 1470 of the program in the word "reregarded"? Should the word be "regarded?" The word of course does not affect the utilization of the program. In fact, before typing this letter I ran the program on myself to see if I was capable in a "physical, emotional and intellectual" way. I was, so I typed this letter.

I read all of the articles twice and all of the advertisements four times, and have already ordered some of the products offered. It is unfortunate that Radio Shack does not yet have any software in print or in cassette.

My biggest need is to attain the ability of inputting data into the 100 that could be uploaded into an IBM, for example, that would fit into an existing IBM program without having to be entered via the IBM keyboard. I sincerely hope that IBM will have this in mind when it introduces its "Peanut" model.

The other thing that puzzles me is the fact that Radio Shack has a computer that weighs less than four pounds but uses a computer cassette recorder (CCR-81) that weighs almost as much. Epson uses a built-in micro recorder. I think every Model 100 owner would happily buy a micro recorder if it weighed less than a pound or so.

Thanks again for having such an excellent publication. Lots of luck to you.

By the way, how about the name *Micro-Port*? Or, if it has to be, *Porto-Micro*?

In any event, what you have done for the industry and many lives, is worth any name.

Rubin L. Gorewitz
New York, NY

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THE MUSIC BOX

AS SEEN ON PCM TV

By Robert Frowenfeld

Ah — *music*. And who could blame a serious Model 100 Portable Computer owner for wanting to hear some soft melodies while looking over his owner's manual? Well, it's no surprise that your PoCo has a built-in sound generator, we told you that last month. Today we're going to take a look into what it takes to make the Model 100 play a song (are you sure Elton John started this way?).

The Model 100's sound generator is capable of producing notes of virtually any frequency over a six octave range. That gives us a pretty wide range of notes to use. To be a little more technical, the SOUND command in BASIC has the ability to generate as many as 16384 different tones. That's because the syntax of the SOUND command is: SOUND pitch, length where pitch is a number or variable expression and can take on any value in the range 0—16383. The length parameter of the command syntax stands for the tone's duration and has its value in the range 1 to 255, where a value of 50 provides a tone with duration of approximately ½ second. It is interesting to note that while the tone generated with a pitch value of 16383 can easily be heard, I found that I could not hear any tones from the Model 100 when the pitch value dropped below 150. I imagine it won't be long before someone comes out with a program to use the Model 100 in testing a person's hearing at higher frequencies.

The song we're going to program today is an old favorite from the movie THE SOUND OF MUSIC called DO RE MI. The nice thing about this song (for all you aspiring Liberaces) is the fact that the whole song can be played by using only eight different notes. Let's get into the program (Listing #1) and look into the "nuts and bolts" that make it work.

To make things run nice and fast, I always (if I can) use the DEFINT statement (line 5) to make all my variable names automatically integers. This can cut down dramatically on those programs that would normally use the Model 100's default variable type of double precision. Here, in line 5, I have

Figure 1

	Octave								
Note	**1**		**2**		**3**		**4**		**5**
G	1	12538	13	6269	25	3134	37	1567	49	783
G#	2	11836	14	5918	26	2959	38	1479	50	739
A	3	11172	15	5586	27	2793	39	1396	51	698
A#	4	10544	16	5272	28	2636	40	1318	52	659
B	5	9952	17	4976	29	2484	41	1244	53	622
C	6	9394	18	4697	30	2348	42	1174	54	587
C#	7	8866	19	4433	31	2216	43	1108	55	554
D	8	8368	20	4184	32	2092	44	1046	56	523
D#	9	7900	21	3728	33	1975	45	987	57	493
E	10	7456	22	3718	34	1864	46	932	58	466
F	11	7032	23	3516	35	1758	47	879	58	439
F#	12	6642	24	3321	36	1660	48	830	60	415

told BASIC that all variable names (A—Z) will be integers. Line 6 sets the variable "N" to 59; this is the total number of notes in the song. Line 7 is a DIMension statement which sets up arrays for the notes to play ("N$"), the duration of each note ("L"), and the words to be displayed as the song is playing ("WD $").

Lines 10-13 are DATA statements that contain the notes (A,B,C, etc.) and the duration, and lines 20-27 are DATA statements that contain the words of the song. For you neophytes to the world of music, the musical scale consists of the letters "A" through "G." A small problem here: how do we play a song with eight notes using the seven letters A,B,C, D,E,F,G? Well don't worry, line 29 holds the clue . . . we'll just call the last letter "H." The song actually starts with the note "C," and continues through the scale C-D-E-F-G-A-B-C, but we will give the second "C," usually called high "C," the designation "H." The DATA statement in line 30 contains the values outlined in the Model 100 user's manual for generating the various notes. The numbers (for this song) start at 2348 and progress downward as the notes get higher in pitch. The last note has a value of 1174, exactly half of the first note's value of 2348. In music, the frequency of a note is exactly double (or half if you're going the opposite direction) of the same note in an adjacent octave. Using this scheme, this would mean that the next "C" note would have a value for generating sound on the Model 100 or 1174/2, or 587, and a look in the owner's manual shows that this is exactly the value of the next highest "C" note!

Line 40 reads in the values from the DATA statements for the notes and durations, and line 45 reads the words into the word array. Now we're ready to play some music!

Line 50 reads in a string "TN$" which will be used to determine the note to be played. The array "FR" is also read in here; this is the list of pitch values referred to in line 30.

Remember the sound command? Line 60 is the beginning of a FOR-NEXT loop which plays each note. But it sure does look a lot more complicated than the SOUND pitch,length format originally described. Well, that's because we want this to work quickly and smoothly, and not get bogged down in loops searching for notes and values. The beauty of this routine, as you will see, is that it takes virtually no time to determine the note to play. But, more importantly, it takes the *same* amount of time to compute which note to play, and that's the secret to keeping the tempo smooth and rhythmic.

The INSTR function imbedded in the SOUND instruction is used here to determine the numeric value for the pitch portion of the SOUND command. This function searches the string "TN$" which is the "CDEFGABH" already described, and looks for the value in the note array "N$." It uses the result of this function, which is a value in the range 1—8 as a pointer to the pitch array "FR." For example, the second note played is a "D." INSTR(TN$,"D") will return a value of 2, and FR(2) is the value 2092 which will be sent to the sound generator to play the note "D."

Now for the duration. The value read in for the length of time each note is to be played ranges from one to eight. In line 60 the length for each note is multiplied by 12, resulting in the actual playing time for each note to vary from 12 to 96 (12 x 8). Remember I said that a value of 50 equals approximately ½ second? I've found that using a value of 12 for one "beat" of music turns out to be a good value; it makes the song move along at an easy-to-listen-to pace.

You may have noticed the PRINT statement in line 60 that is executed just before each note is played. This prints the element of the "WD$" array to the screen. These "elements" are the words to the song DO RE MI.

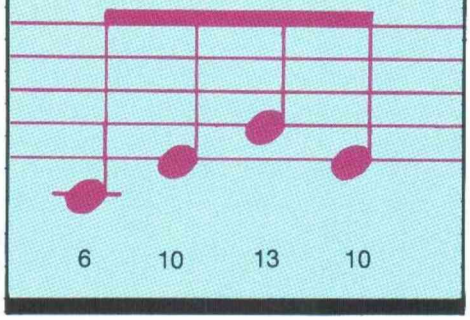
Once the song is finished, the GOTO 55 statement in line 70 simply clears the screen and starts the song playing over.

While I am not a musician by any means, I have been able to take some simple pieces of music (like this one) and transfer the notes to my PoCo to give me some soothing moments while I contemplate the world's more profound problems. In order to do this, I've developed a method to facilitate the transferral of sheet music to a numerical format.

Using the chart that is found in the Model 100's manual under the SOUND command, I have numbered each note,

starting at "1" for the "G" in the lowest octave with a pitch of 12538 and ending at "60" with the B-sharp in the highest octave with a pitch of 415 (see Figure #1). Next, I take a piece of sheet music and number each note with the matching value in the table (see Figure #2). The result is a series of numbers which represents the pitch values to be used in the SOUND command. The only remaining task is to also assign a duration to each note. A simple method (but by no means the only one) to incorporate the length of each tone into the pitch value is to change the pitch value. Since there are 60 notes in the five octaves in Figure #1, no coded pitch value will be higher than 99. Let's say, for the moment that we will use only whole beats in our music scheme. To make the tone last two beats, I simply add 100 to the coded value; for three beats I add another 100, and so on. For example, take the "C" note in the second octave. For a single beat it would be coded as

Figure 2:



18, for 2 beats it would be 118, and to hold the tone for a full bar of four beats, the value would be coded as 318.

Armed with this novel (yet far from revolutionary) idea, I have proceeded to code the numeric values for the song Music Box Dancer by Frank Mills. Using the TEXT program built into the Model 100, I created the document file named BOXDAN.DO that appears in Listing #3. This text file became the data file for the program in Listing #2 which reads the data file and plays the music. You will notice that all notes, except for the very last one, are one beat in length.

Once the data is typed into the text file, I just run the program in Listing #2 and enjoy a few moments of melodic relaxation. I would like to take this opportunity to encourage you Model 100 owners to develop data for your favorite songs and send them in to us at *PCM*. We'll be happy to select some of the nicest tunes and publish them in next month's issue. Until then . . . play it again, Sam!

Listing 1:

```
5 DEFINT A-Z
6 N=59
7 DIM N$(N),L(N),WD$(N)
10 DATA C,3,D,1,E,3,C,1,E,2,C,2,E,4,D,3,
E,1,F,1,F,1,E,1,D,1,F,8
11 DATA E,3,F,1,G,3,E,1,G,2,E,2,G,4,F,3,
G,1,A,1,A,1,G,1,F,1,A,8
12 DATA G,3,C,1,D,1,E,1,F,1,G,1,A,8,A,3,
D,1,E,1,F,1,G,1,A,1,B,8,B,3,E,1,F,1,G,1,
A,1,B,1,H,7
13 DATA H,1,B,1,A,2,F,2,B,2,G,2,H,2,G,2,
E,2,D,2
20 DATA DO - ,A ,DEER ,A ,FE,MALE ,DEER.
21 DATA RE - ,A ,DROP ,OF ,GOL,DEN ,SUN.
22 DATA MI - ,A ,NAME ,I ,CALL ,MY,SELF.
23 DATA FA - ,A ,LONG ,LONG ,WAY ,TO ,RU
N.
24 DATA SO - ,A ,NEE,DLE ,PUL,LING ,THRE
AD.
25 DATA LA - ,A ,NOTE ,TO ,FOL,LOW ,SO.
26 DATA TI - ,A ,DRINK ,WITH ,JAM ,AND ,
BREAD.
27 DATA THAT ,WILL ,BRING ,US ,BACK ,TO
,DO ,DO ,DO ,DO
29 DATA "CDEFGABH"
30 DATA 2348,2092,1864,1758,1567,1396,12
44,1174
40 FORI=1TON:READ N$(I),L(I):NEXTI
45 FORI=1TON:READWD$(I):NEXTI
50 READ TN$:FORI=1TOLEN(TN$):READ FR(I):
NEXTI
55 CLS
60 FORI=1TON:PRINTWD$(I);:SOUND FR(INSTR
(TN$,N$(I))),L(I)*12
61 IFRIGHT$(WD$(I),1)="."THENPRINT
65 NEXTI
70 GOTO55
```

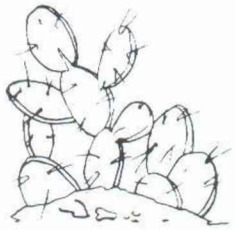
Listing 2:

```
1 CLEAR 500
5 DEFINT A-Z
7 ON ERROR GOTO 200
10 DIM J(60)
100 DATA 12538,11836,11172,10544,9952,93
94,8866,8368,7900,7456,7032,6642
110 FORI=1TO12:READJ(I):NEXTI
120 FORI=2TO5:FORJ=1TO12:J((I-1)*12+J)=J
((I-2)*12+J)/2:NEXTJ:NEXTI
125 CLS
130 OPEN"BOXDAN"FOR INPUT AS 1
131 II=0
140 INPUT#1,I:K=IMOD100
142 II=II+1
150 SOUND J(K),12*(1+INT(I/100))
160 GOTO140
200 CLOSE:GOTO130
```

Listing 3:

```
6,10,13,10,18,13,10,13
6,10,13,10,18,13,10,13
6,10,13,10,18,13,10,13
6,10,13,10,18,13,10,13
18,13,18,22,18,22,25,22,30,29,27,25,6,10
,13,18,25,23,20,17,13,17,20,23,22,18,27,
25,10,13,18,13
18,13,18,22,18,22,25,22,30,29,27,25,6,10
,13,18,25,23,20,17,13,17,20,23,18,13,22,
18,10,13,18,1
30,27,23,18,15,18,23,27,25,18,27,25
6,10,13,18,25,23,20,17,13,17,20,23,22,18
,27,25,10,13,18,13
30,27,23,18,15,18,23,27,25,18,27,25
6,10,13,18,25,23,20,17,13,17,20,17,18,13
,22,18,318
```

PCM



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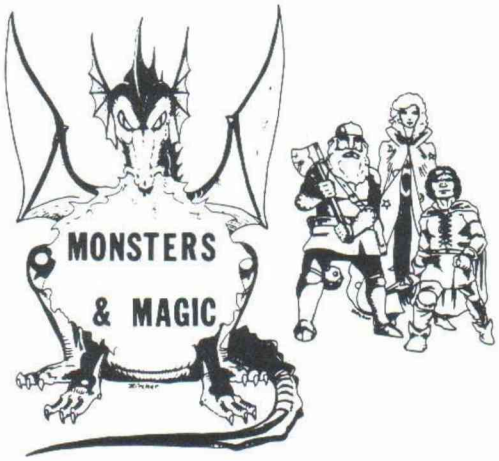

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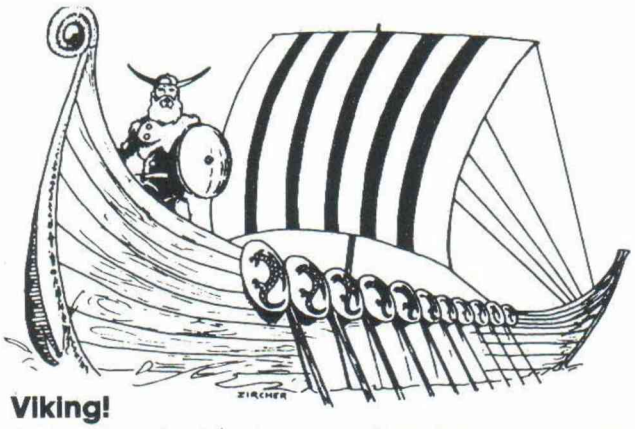

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Analyze Your Data with Linear Curve Fitting

By Thomas J. Flamer

Very often it is desirable to analyze data and to find a relationship between two variables and express this relationship in mathematical form by determining an equation connecting the variables.

When the data is plotted on a rectangular coordinate system it is often possible to visualize one or more smooth curves which approximate the data. In particular, if the data seem to be approximated by a straight line we say that there exists a linear relationship between the two variables.

The general problem of finding equations of approximating curves which fit given sets of data is called curve fitting. In this article we restrict our discussion to linear curves.

One of the main reasons for curve fitting is to estimate one of the variables from a given value of the other. This process of estimation is called regression and when a straight line is used to fit the data it is called linear regression.

The accompanying program determines the best straight line that fits a set of data. The data may be entered manually from the keyboard or serially from a data file. The program proceeds to calculate means, variances, covariances and standard errors of estimate which are displayed and subsequently used to perform a least-squares fit designed to minimize the sum of the squares of the deviations of the actual data points from the straight line of best fit. The equation of the best line along with the slope, Y-intercept, and errors are displayed, and from there the user encounters a menu which allows him to:

1) Perform linear regression, which means that additional data points can be interpolated or extrapolated from the determined best line. The user can specify whether he would like to determine X from a given Y or Y from a given X.
2) Compare actual data to that estimated by the least-squares line.
3) Plot the actual data on Cartesian coordinates as well as the best line which passes through them. Maximum and minimum values of X and Y are displayed.
4) Review statistical results previously displayed.
5) End the program

Data files to be input should be in the form of X,Y pairs; the program determines the number of data pairs in a data file and stores them in arrays dimensioned X(100), Y(100).

The program was designed to be used on a Model 100 with 24K.

The listing:

```
5 '***********************************
6 '***  LINEAR REGRESSION PROGRAM  ***
8 '***  BY FLAMER [JUNE 10, 1983]  ***
9 '***********************************
11 '*
12 '*
14 '*** VARIABLES ***
16 ' N   NUMBER OF POINTS
18 ' X   VALUE OF X
20 ' Y   VALUE OF Y
22 ' XM   MEAN OF X
23 ' YM   MEAN OF Y
24 ' XD  STANDARD DEVIATION OF X
26 ' YD  STANDARD DEVIATION OF Y
28 ' C   COVARIANCE OF X AND Y
30 ' CC  CORRELATION COEFFICIENT
32 ' M   SLOPE OF REGRESSION LINE
34 ' B   Y-INTERCEPT OF REGRESSION LINE
36 ' SX  SUM OF X-VALUES
38 ' SY  SUM OF Y-VALUES
40 ' XX  SUM OF SQUARED X-VALUES
42 ' YC  CALCULATED Y-VALUE
45 H$="X-ACTUAL  Y-ACTUAL  Y-CALCULATED"
55 N1$="######.####":N2$="####.####":N3$
="+####.####":N4$=".##"
60 RV$=CHR$(27)+"p":NM$=CHR$(27)+"q"
70 DEFINT I,J,K,L
85 ONERRORGOTO1150
90 DIMX(100),Y(100),YC(100)
91 CLS:PRINT"       LINEAR REGRESSION PR
OGRAM":PRINTSTRING$(39,"-");
```

```
92 PRINT:PRINT"THIS PROGRAM WILL PERFORM
 A STATISTICAL ";
93 PRINT"ANALYSIS                    ";
95 PRINT"     OF YOUR DATA AND FIT THAT
DATA     ";
96 PRINT"          TO A LEAST-SQUARES LIN
E        ";
98 GOSUB6400
100 CLS
110 PRINTRV$
112 PRINT@8,"LINEAR REGRESSION PROGRAM"
113 PRINTNM$
120 PRINT"DATA ENTRY BY KEYBOARD--<1>"
140 PRINT
160 PRINT"DATA ENTRY BY FILE-------<2>"
180 PRINT
220 INPUT"WHICH NUMBER ";RE
225 IF(RE>2)OR(RE<=0)THENBEEP:GOTO100
240 ON RE GOSUB 1000,2000
242 P=N
243 P=INT(P/2)
244 IF(P=0)THEN260
245 Q=N-P
246 FORJ=1TOQ
247 I=J
248 R=I+P
249 IF(X(I)<X(R))THEN257
250 T1=X(I):T2=Y(I)
251 X(I)=X(R):Y(I)=Y(R)
252 X(R)=T1:Y(R)=T2
253 I=I-P
254 IF(I>0)THEN248
257 NEXT
258 GOTO243
260 FORI=1 TO N
280 X=X(I):XM=SX/N
300 Y=Y(I):YM=SY/N
320 SX=SX+X:SY=SY+Y
340 XY=XY+X*Y
360 XX=XX+X*X:YY=YY+Y*Y
380 NEXT
400 D2=XX-SX*SX/N:XD=SQR(D2/(N-1))
420 D3=XY-SX*SY/N
440 D4=YY-SY*SY/N:YD=SQR(D4/(N-1))
500 M=D3/D2
520 B=((XX*SY-SX*XY)/N)/D2
540 C=(XY-SX*SX/N)/(N-1):CC=D3/SQR(D2*D4
)
560 SE=SQR((YY-SY*B-M*XY)/(N-2))
580 EM=SE/SQR(D2)
600 EB=EM*SQR(XX/N)
620 FORI=1TON
640 YC(I)=M*X(I)+B
660 NEXT
800 CLS
805 PRINT"MEAN OF X EQUALS  ";USINGN1$;X
M
810 PRINT"MEAN OF Y EQUALS  ";USINGN1$;Y
M
815 PRINT
820 PRINT"STANDARD DEVIATION OF X IS  ";
USINGN2$;XD
825 PRINT"STANDARD DEVIATION OF Y IS  ";
USINGN2$;YD
830 PRINT"COVARIANCE OF X AND Y IS  ";US
INGN1$;C
835 PRINT"CORRELATION COEFFICIENT IS  ";
USINGN2$;CC
850 GOSUB6400
870 PRINT"    *****LINEAR COEFFICIENTS**
***"
875 PRINT"Y INTERCEPT IS ";USINGN1$;B;:P
RINT" error:";USINGN4$;EB
880 PRINT"     SLOPE  IS   ";USINGN2$;M;
:PRINT" error:";USINGN4$;EM
890 PRINT"EQUATION OF LINE THROUGH POINT
S;"
893 PRINTRV$;
895 PRINT"  Y = ";USINGN1$;M;:PRINT"X
";USINGN3$;B
897 PRINTNM$;
910 GOSUB6400
922 CLS:PRINT" <1>---LINEAR REGRESSION"
924 PRINT" <2>---COMPARE ACTUAL TO ESTIM
ATED VALUE";
926 PRINT" <3>---PLOT DATA"
927 PRINT" <4>---REVIEW STATISTICS":PRIN
T" <5>---QUIT "
```


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```
929 PRINT:INPUT"WHICH NUMBER ";RE
930 ONREGOSUB3000,4000,6000,800,999
940 BEEP
950 GOTO922
999 CLS:END
1000 CLS
1020 INPUT"NUMBER OF DATA POINTS";N
1040 PRINT
1060 FORI=1TON
1080 PRINTI;TAB(5);:INPUT"ENTER X , Y";X
(I),Y(I)
1100 NEXT
1120 RETURN
1150 IFERR=52THENBEEP:PRINTRV$;:PRINT"SO
RRY NO SUCH FILE EXISTS IN MEMORY!!";:PR
INTNM$
1151 FORI=1TO2000:NEXT: RESUME2000
2000 CLS
2020 LINE INPUT"NAME OF DATA FILE IS ";F
$
2030 IFF$=""THENGOTO2000
2040 OPEN F$ FORINPUTAS1
2050 K=0
2060 K=K+1
2065 PRINT@80,"NUMBER":PRINT@90,"X-VALUE
":PRINT@105,"Y-VALUE"
2066 PRINT@120,K:PRINT@130,X:PRINT@145,Y
2080 INPUT#1,X,Y
2100 X(K)=X:Y(K)=Y
2120 IFEOF(1)THEN2160
2140 GOTO2060
2160 N=K
2180 RETURN
3000 CLS
3005 RE=0
3010 PRINTRV$
3012 PRINT"  LINEAR REGRESSION
   "
3014 PRINT"CORRELATION COEFFICIENT: "USI
NGN2$;CC;
3016 PRINTNM$
3020 PRINT" <1>---CALCULATE Y GIVEN X "
3040 PRINT" <2>---CALCULATE X GIVEN Y "
3060 INPUT"WHICH NUMBER ";RE
3065 IF(RE>2)OR(RE<=0)THENBEEP:GOTO3000
3070 IFRE=2THENGOTO3100
3082 INPUT"ENTER YOUR VALUE OF X ";X
3083 Y=M*X+B
3084 PRINT:PRINT"FOR X = ";X;" Y = ";Y
3086 LINEINPUT"ANOTHER CALCULATION ? Y/N
";RE$
3090 IFRE$="Y"THEN3000
3095 RETURN
3100 INPUT"ENTER YOUR VALUE OF Y ";Y
3120 X=(Y-B)/M
3140 PRINT:PRINT"FOR Y = ";Y;" X = ";X
3160 LINEINPUT"ANOTHER CALCULATION ? Y/N
";RE$
3180 IFRE$="Y"THEN3000
3190 RETURN
4000 CLS
4020 PRINTH$
4060 FORI=1TON
4070 IF(I/6-INT(I/6))=0THENGOSUB5000
4080 Y=M*X(I)+B
4100 PRINTX(I)TAB(10)Y(I)TAB(20)USINGN1$
;Y
4120 NEXT
4130 GOSUB6400
4140 RETURN
5010 GOSUB6400
5030 PRINT
5040 PRINTH$
5060 RETURN
6000 CLS
6010 ONERRORGOTO6300
6020 C1=Y(1):C2=C1
6030 FORI=1TON
6040 IFC1<=Y(I)THEN6060
6050 C1=Y(I)
6060 IFC2>=Y(I)THEN6080
6070 C2=Y(I)
6080 NEXT
6090 LINE(110,30)-(210,30),1
6100 LINE(160,5)-(160,55),1
6110 PRINT@27,"Y"
6120 PRINT@155,"X"
6130 Y1=C1:Y2=C2
6140 KX=100/(X(N)-X(1))
6150 KY=50/(Y2-Y1)
6160 FORI=1TON
6170 PSET((X(I)-X(1))*KX+110,55-(Y(I)-Y1
)*KY)
6180 NEXT
6182 FORX=X(1)TOX(N)STEP(X(N)-X(1))/50
6184 PSET((X-X(1))*KX+110,55-((M*X+B)-Y1
)*KY)
6186 NEXT
6188 PRINT@0,"Y-MAX";
6190 PRINT@7,USING"#.##^^^^";Y2
6195 PRINT@240,"Y-MIN"
6200 PRINT@247,USING"#.##^^^^";Y1
6208 IFLEN(STR$(X(1)))>9THENPRINT@297,US
ING"#.###^^^^";X(1);:GOTO6215
6210 PRINT@297,X(1);
6215 IFLEN(STR$(X(N)))>9THENPRINT@310,US
ING"#.###^^^^";X(N);:GOTO6230
6220 PRINT@316-LEN(STR$(X(N))),X(N);
6230 GOSUB6400
6260 RETURN
6300 BEEP:RESUME 6188
6400 PRINTRV$;:PRINT@280,"<PRESS ANY KEY
>";:FORK=1TO200:NEXT:PRINTNM$;:FORK=1TO2
00:NEXT
6450 R$=INKEY$
6475 PRINT@280,"<PRESS ANY KEY>";:FORK=1
TO200:NEXT
6500 IFR$=""THEN6400
6520 CLS
6550 RETURN
```

PCM

A Timer For Your Chess Game

By Larry Boulet

This short program is called *Chess Timer* and uses some of the new BASIC features available on the PoCo Microsoft BASIC. The program waits until a key is pressed (any key) and starts timing the player on the white side. When any key is pressed again, the white clock stops and the black starts. Every key press alternates sides unless a total of five minutes elapses at which time the computer emits a series of beeps indicating the end of the game. The player who ran out of time is the loser.

The listing:

```
10 '*****************************
20 '*    Chess Timer            *
30 '*        by                 *
40 '*    Larry Boulet           *
50 '*for longer times, change   *
60 '*variable t3 in line 190    *
70 '*and t4 in line 360         *
80 '*****************************
90 '*****************************
100 CLS:PRINTTAB(15);"Chess Timer"
110 PRINT:PRINTTAB(13);"**Hit any key**"
115 PRINT:PRINT:PRINT:PRINTTAB(11)"white
      black"
117 LINE(52,30)-(108,40),1,B
118 LINE(130,30)-(186,40),1,B
120 IN$=INKEY$:IFIN$=""THEN120
130 PRINT@170,T3;":";T2:PRINT@183,T3;":"
;T2
135 T3=0:T2=0:T1=0:T%=0:PRINT
137 T1=T%
140 TI$=MID$(TIME$,8,1)
145 IN$=INKEY$:IFIN$<>""THENGOTO310
160 T%=VAL(TI$)
170 IFT1=T%THENGOTO140
180 PRINT@170,T3;":";T2
190 IFT3=5THEN500
195 T2=T2+1
210 IFT2>59THENT2=0:T3=T3+1
220 GOTO137
300 T4=0:T5=0:T6=0:T7=0
310 T6=T7
320 TI$=MID$(TIME$,8,1)
325 IN$=INKEY$:IFIN$<>""THENGOTO137
330 T7=VAL(TI$)
340 IFT6=T7THENGOTO320
350 PRINT@183,T4;":";T5
360 IFT4=5THEN500
370 T5=T5+1
380 IFT5>59THENT5=0:T4=T4+1
390 GOTO310
500 BEEP:BEEP:BEEP:BEEP
510 END
```

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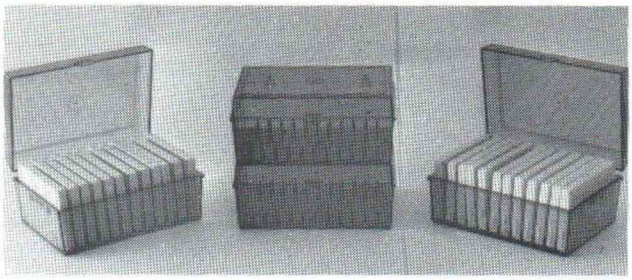

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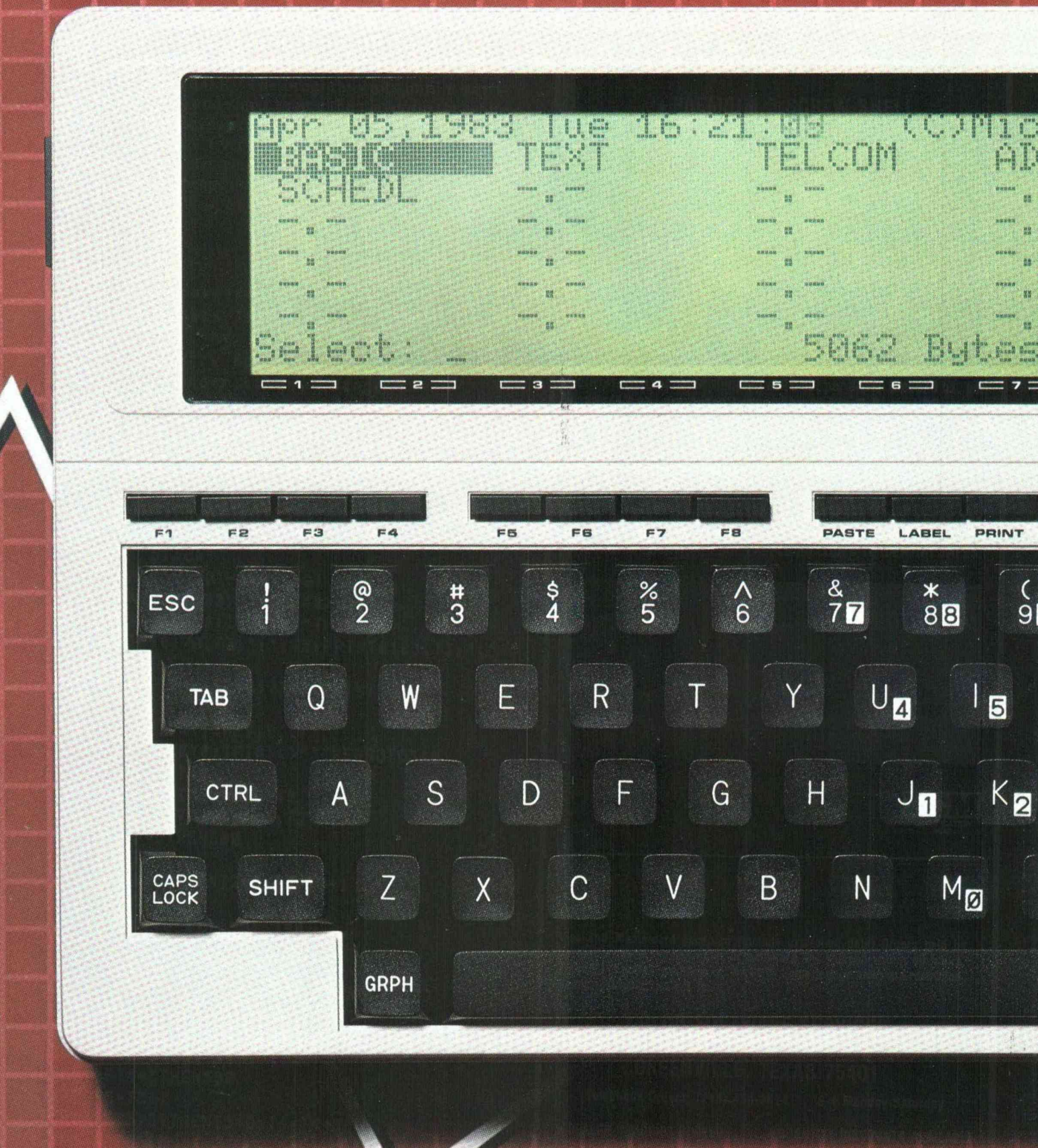

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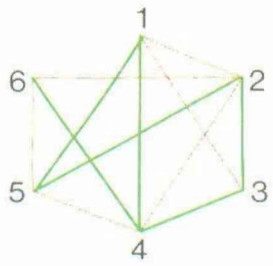
TRY THIS TRIANGLE CHALLENGE

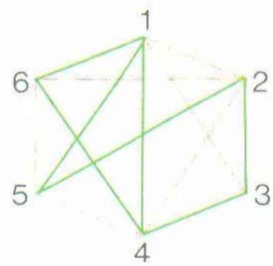
BY RONALD PALUDAN

Figure 1



Configuration after the computer and player have completed their sixth moves. The computer has just made the 6-2 connection. The player's turn is next.

Figure 2



Here the computer wins because the player (solid lines) had only the 1-6 line available to draw, thus completing a triangle composed solely of the player's lines (1-6-4).

SIM is a two player game (you and the computer). After asking for your name and whether you would like to go first, the program will print six numbers in a hexagonal arrangement on the left side of the screen. You and the Model 100 will take turns drawing lines connecting the numbered vertices of the hexagon. Your lines will be solid, while the computer draws a dotted line. To draw a line, simply enter the two numbers that you wish to connect. You cannot connect two numbers that have already been connected by either you or the computer.

The object of *SIM* is to avoid completing a triangle composed of your own lines. Only triangles with vertices on the six starting points are considered. The final two moves of a sample game are shown in Figure 1 and Figure 2.

The game of *SIM* was first published by Gustavus Simmons (*The Journal of Recreational Mathematics,* V.2, April, 1969, p. 66). In his article, Simmons proved that a draw was not possible, and later analysis showed that there is a winning strategy for the second player. For over a year I was convinced that the program made the computer unbeatable when the human opponent went first. However, while preparing this article, I found a strategy which would beat the computer when I went first. A challenge for the reader is to first perfect playing the game as the second player, and then find a way to beat the computer when it moves second.

This program uses a heuristic algorithm developed by John Nairne and A. B. Sperry (*The Journal of Recreational Mathematics*, V.6, Fall, 1973, pp. 243—247). Nairne and Sperry estimated that there are 109,132,115,040 possible games of *SIM*, so get started and good luck!

The listing:

```
10 CLS:SCREEN0,0:PRINT@17,"T-SIM":PRINT@
93,"BY RON PALUDAN":FORZ=1TO500:NEXT
100 DIMT%(4,15),H%(20),C%(20),L%(20),XL%
```

```
(6),YL%(6)
110 FORN=1TO15:FORJ=1TO4:READT%(J,N):NEX
TJ,N
120 FORN=1TO6:READXL%(N),YL%(N):NEXT
130 CLS
200 LINEINPUT"YOUR NAME ? ";N$:CLS
205 PRINT"DO YOU WANT TO GO FIRST ?"
210 Q$=INKEY$:IFQ$=""THEN210
220 IFQ$<>"N"ANDQ$<>"Y"ANDQ$<>"y"ANDQ$<>
"n"THENBEEP:CLS:GOTO205
230 FORN=1TO20:L%(N)=0:H%(N)=0:C%(N)=0:N
EXT
300 CLS
301 MC=1:MH=1
310 PRINT@30,"1":PRINT@104,"6":PRINT@116
,"2"
320 PRINT@224,"5":PRINT@236,"3":PRINT@31
0,"4";
400 IFQ$="Y"ORQ$="y"THEN700
410 I=INT(RND(9)*6)+1:J=INT(RND(8)*6)+1:
GOSUB1000
420 IFL%(X)=1ORI=JTHEN410
430 PL=I:Y=0:L%(X)=1:GOTO550
440 PL=1:EX=81:FORI=1TO5:FORJ=I+1TO6
450 GOSUB1000:IFL%(X)=1THEN540
460 G=0:FORN=1TO4:H=H%(T%(N,X)):C=C%(T%(
N,X))
470 IFH=0ANDC=0THENG=G+1
480 IFH=1ANDC=0THENG=G+2
490 IFH=0ANDC=1THENG=G+4
500 IFH=1ANDC=1THENG=G+0
510 IFH=0ANDC=2THENG=G+20
520 IFH=2ANDC=0THENG=G+4
530 NEXTN:IFG<EXTHENEX=G:EJ=J:EI=I
540 NEXTJ,I:J=EJ:I=EI:GOSUB1000
550 REM PLOT COMPUTER'S MOVE
555 IFXL%(I)=XL%(J)THEN600
560 B=YL%(I):M=(YL%(I)-YL%(J))/(XL%(I)-X
L%(J))
570 K=3:IFXL%(I)>XL%(J)THENK=-3
580 FORZ=XL%(I)TOXL%(J)STEPK
590 Y=M*(Z-XL%(I))+B:PSET(Z,Y):NEXTZ:GOT
O680
600 K=3:IFYL%(I)>YL%(J)THENK=-3
610 FORZ=YL%(I)TOYL%(J)STEPK:PSET(XL%(I)
,Z):NEXTZ
680 FORN=1TO4:C%(T%(N,X))=C%(T%(N,X))+1:
IFC%(T%(N,X))=3THEN2000
690 NEXTN:L%(X)=1
700 PRINT@0,"FIRST  POINT ?";
705 Q$=INKEY$:I=VAL(Q$):IFQ$=""ORI<1ORI>
6THEN705
710 PRINTI:PRINT@40,"SECOND POINT ?";
715 FORT=1TO200:NEXT
720 W$=INKEY$:J=VAL(W$):IFW$=""ORJ<0ORJ>
6ORJ=ITHEN720
730 PRINTJ:GOSUB1000:IFL%(X)=0THEN800
740 PRINT@0,SPACE$(20):PRINT@40,SPACE$(2
0)
750 BEEP:GOTO700
800 REM PLOT HUMAN'S MOVE
810 LINE(XL%(I),YL%(I))-(XL%(J),YL%(J))
900 FORN=1TO4:H%(T%(N,X))=H%(T%(N,X))+1
910 IFH%(T%(N,X))=3THEN3000
920 NEXT:L%(X)=1
950 PRINT@0,SPACE$(20):PRINT@40,SPACE$(2
0)
990 GOTO440
1000 IFI>JTHENK=J:J=I:I=K
1010 X=15:FORZ=5TOISTEP-1:X=X-(5-Z):NEXT
:X=X-(6-J):RETURN
2000 N$="COMPUTER"
3000 PRINT@160,N$" LOSES!"
4000 PRINT@240,"PLAY AGAIN ?"
4010 Q$=INKEY$:IFQ$=""THEN4010
4020 IFQ$="Y"ORQ$="y"THEN130
5000 DATA1,2,3,4,1,5,6,7,2,5,8,9
5010 DATA3,6,8,10,4,7,9,10,1,11,12,13
5020 DATA2,11,14,15,3,12,14,16,4,13,15,1
6
5030 DATA5,11,17,18,6,12,17,19,7,13,18,1
9
5040 DATA8,14,17,20,9,15,18,20,10,16,19,
20
6000 DATA183,9,213,20,213,44,183,55,150,
44,150,20
```

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Among Printer Utilities *LLST* Is Without Parallel

By Dale Wheeler

A utility to use an MX-80 equipped with serial interface and the Model 100 via the RS-232 port.

Shortly after purchasing my M100 it became necessary to produce listings of BASIC programs that were being developed. The only problem was that my MX-80 printer is equipped with a serial interface for use with my Color Computer. With the interface in place, the parallel input to the printer cannot be used.

Several options were available to solve this problem. The first was to buy another printer for use with the Portable. A flat pocketbook and harsh frowns from the spouse seemed to eliminate this fix!

A new interface that can be switched between the serial and parallel inputs was deleted from the list for the same reason.

Unplugging the serial interface when using the printer with the Model 100 seemed impractical and downright bothersome.

The quickest and cheapest answer to the problem turned out to be the utility program listed below.

Getting Ready

Before the program can be used, a printer cable will have to be purchased or made up to connect the RS-232 connector on the Model 100 to the MX-80 serial interface. Only two of the 25 conductors are necessary. Pin 7 of the computer connector is tied to pin 7 of the printer connector. This provides a SIGNAL GROUND path for the two machines. Next, pin 2 on the computer connector (Transmit Data) is tied to pin 3 on the printer (Receive Data). This is the data path.

Experimenting has shown no way to use any of the other pins to provide a PRINTER READY signal for use in controlling the output of the computer. If anyone can provide this information please do so by writing me through *PCM*.

After *LLST* has been keyed in, you may want to customize it to your particular printer by changing the OPEN"COM: command in line 30. Refer to the M100 manual, page 165, for information on the correct syntax. The program is set up for use with 8 bit words and a Baud rate of 2400.

The program to be listed must be saved to RAM in ASCII format with the SAVE"name",A command.

Running the Program

Now run the *LLST* program and respond to the "File Name?" prompt with the name of the program saved earlier in ASCII. Your program will be listed in standard format. No fancy line breaks or page breaks are provided.

Since the printer cannot tell the computer when it is or is not ready to receive data, a delay loop is provided in the program. The length of the delay was arrived at by trial and error and although it sometimes *seems* too long, experience has shown otherwise. On slower printers, of course, a longer delay will be necessary.

The program can be used to print most files with a .DO suffix, but the program may crash when printing files created by the *TEXT* program.

The listing:

```
1  LLST
5 CLEAR1000
10 MAXFILES=2
12 F1$="":CLS:PRINT:FILES:INPUT"File nam
e";F1$:IFLEN(F1$)>60RF1$=""THENBEEP:GOTO
12
14 F1$="RAM:"+F1$+".DO"
20 CLOSE#1:OPENF1$FOR INPUT AS 1
30 OPEN"COM:68E2E"FOR OUTPUT AS 2
40 IFEOF(1)THENBEEP:GOTO60ELSELINEINPUT#
1,A$
42 IFLEN(A$)<78THENXX=LEN(A$)ELSEXX=78
44 B$=LEFT$(A$,XX):A$=RIGHT$(A$,LEN(A$)-
XX)
48 PRINTB$:PRINT#2,B$CHR$(13);
50 FOR X=1 TO 1500:NEXTX:IFLEN(A$)>0THEN
42ELSE40
60 CLOSE:PRINT:INPUT"Press <Q> to quit o
r <ENTER> to list    another program";QU
IT$
70 IF QUIT$="Q"ORQUIT$="q"THENEND
80 RUN
```

PCM

FOUND! The M100's 'Hidden' Cursor Control Keys

By Frank Hogg

Using the Model 100's cursor control keys has always been a pain. I rarely remember which key is which without looking at them and I often hit the wrong one. Wouldn't it be nice if it had cursor keys that were logically placed so that I wouldn't have to fumble? Well maybe you, like me, didn't know it, but the M100 has that built in! That's right, they are built in, and Radio Shack even told you about them. Look on page 59 of your manual for reference. Under the heading "Using Control Codes and Other Special Key Combinations" will give you all the information in a way that almost guarantees that you will not realize its importance.

Refer to the keyboard layout below for a much better idea of how this works. If you are familiar with *Wordstar* or *DynaStar* text processors you will recognize the layout. The beauty of this over using the cursor keys is that you can do the cursor movement with only one hand. Use your pinky for the control key and hit the appropriate key with your index finger. Using the cursor keys is very slow in comparison and requires two hands, one for the control key and one for the cursor key. Also, the cursor keys are not laid out in a logical way and are difficult to remember.

Looking at the layout below you will notice a pattern with the "ESDX" keys. These keys do the same thing that the cursor keys do with the exception that they make much more sense. E is up, X is down, S is left and D is right. The A and F keys do the same as using SHIFT and the right and left cursor keys, A is left word and F is right word. Study the pattern and you will see the logic of this layout. Without this layout below, I was able to use these keys after only a few minutes. That may be because I use

Keyboard Layout

```
<      <      ↑      >      ↑      print                        prntr
line   file   char   line   disp          cut   tab  copy     codes
Q  W  E  R  T  Y  U  I  O  P  [

   <      <      >      >
word   char   char word  save  bksp              select
A  S  D  F  G  H  J  K  L  ;  '

   v      v      cancl        v
file   char                 loaddsplay
Z  X  C  V  B  N  M  ,  .  /
```

(Frank Hogg is the president of Frank Hogg Laboratory, one of the world's largest suppliers of software for 6809 based computers. He and his wife Linda live in Syracuse, New York.)

DynaStar on the Color Computer so often and most of the keys are the same. When I found this out I was much more impressed with the 100 than before. I never did think that the cursor keys were very well laid out, but with this ability, I now never use the cursor keys in the editor.

You can use the CTRL keys in the M100's BASIC editor but the A and F keys will have a tough time determining just what constitutes the beginning of the next word. In the line

```
10 B=INT(27*A)
```

the editor will think that B is one word and 27 is the next. It doesn't think that INT is a separate word. This probably has something to do with the special characters used in BASIC programs and should give you no problem. I just don't use A and F while in BASIC.

CTRL P is a new one and is only mentioned on page 60 after all the other stuff, at least as far as I know, because I haven't read the manual all the way through yet. (Who ever does!) CTRL P allows the embedding of printer control codes in your text. Because I always upload my files to our big GIMIX OS9 system for final processing, I have never used these codes, but if you are using a printer hooked to your 100 I am sure that these will be of use to you.

Just as a point of interest, I thought you might like to know what I use my M100 for. As some of you may know, I have a software company for the TRS-80 Color Computer. We do not have anything for the 100, so why, you may ask, do I have one? Good question, and, as my wife would say, "Because I didn't already have one." Oh well, some people just don't understand the necessities of life, I guess.

I didn't use my Model 100 very much for the first few months I had it because I have computers at home and at work and I am never far away from one when the need arises, at least until now, that is. Right now, it is the middle of July and we are spending most of our time at a camp 30 miles outside of town. Last year I hauled a Color Computer with disk drives and a printer and all the wires and cables, etc., down here and it was a hassle for two reasons; first, because this is supposed to be camp and not work, and second because of all the stuff I had to carry. This year I decided to leave the CoCo home and not bring any computer down here. That lasted until I packed the car and, what do you know, I forgot to leave the M100 home. Good thing, too, as the peace and quiet has given me the time to catch up on most of my writing. After I get into work I hook up the M100 up to the RS-232 port of our multi-user GIMIX OS9 system and using *TELCOM* and *TERM* I can then log on the system as a terminal. It is then a simple matter to upload the files the the GIMIX and with *DynaStar*, I do the final word processing and the spelling checking with *DynaSpell* (because I can't spell very well). Then it's just a simple matter to print it out and away I go.

I did find that 8K was not enough, so I bought an 8K chip from Computer Plus and installed it myself in about five minutes. This gives me about six or seven pages of text storage which is about all I want to write while down at camp. When the chips come down in price sometime this fall I will buy the other 16K. But at the cost of them now, I am going to wait until I really need them before I buy them.

All in all, I really like the Model 100 and am glad I bought it. My wife, however, just gives me a funny look whenever I mention it.

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On The Road

By Robert Frowenfeld
PCM Contributing Editor

In our first edition of *On The Road* we looked at a loan amortization program which can be very useful when the need arises to borrow or loan money. As you know, there are many other types of financial computations that, when used properly, become extremely valuable tools in conducting day-to-day financial affairs. Today we are going to look at a variety of economic analyses that can turn your Portable Computer into a powerful financial decision maker. If you've ever seen one of those calculators which has special buttons for such computations as compound interest, present worth, etc., you will be happy to know that the program presented here will perform these, as well as more complex, calculations.

I've named this program *ECANL* which is my contraction for the term *EC*onomic *AN*a*L*lyzer. *ECANL* was designed to perform the following types of economic evaluations (see main menu listing):

1) Compound Amount
2) Series Compound Amount
3) Sinking Fund
4) Capital Recovery
5) Present Worth
6) Series Present Worth
7) Gradient Present Worth
8) Gradient Uniform Series

(Robert Frowenfeld owns his own computer programming firm in Louisville, Ky., and has completed his graduate coursework in Computer Science at the University of Louisville.)

The following table shows the formulas required to perform each computation:

1) Compound Amount:

$$F = P(1 + i)^n$$

2) Series Compound Amount:

$$F = A\left[\frac{(1 + i)^n - 1}{i}\right]$$

3) Sinking Fund:

$$A = F\left[\frac{i}{(1 + i)^n - 1}\right]$$

4) Capital Recovery:

$$A = P\left[\frac{i(1 + i)^n}{(1 + i)^n - 1}\right]$$

5) Present Worth:

$$P = F(1 + i)^{-n}$$

6) Series Present Worth:

$$P = A\left[\frac{(1 + i)^n - 1}{i(1 + i)^n}\right]$$

7) Gradient Present Worth:

$$P = \frac{G}{i}\left[\frac{(1 + i)^n - 1}{i} - n\right]\left[\frac{1}{(1 + i)^n}\right]$$

8) Gradient Uniform Series:

$$A = G\left[\frac{1}{i} - \frac{n}{(1 + i)^n - 1}\right]$$

Where:
i = interest rate per interest period. In the equations above, the interest rate is stated as a decimal (that is, 8 percent interest is 0.08).
n = number of interest periods.
P = a present sum of money.
F = a future sum of money. The future sum F is an amount, n interest periods from the present, that is equivalent to P with interest rate i.
A = an end-of-period cash receipt or disbursement in a uniform series, continuing for n periods, the entire series equivalent to P or F at interest rate i.
G = a uniform arithmetic gradient representing a period-by-period increase in payments or disbursements.

You will notice that each of the above formulas uses the exponential expression $(1 + i)^n$. This is used to compute the compounding effect of interest from one period to the next. The table below illustrates the compounding effect of 10 percent interest paid annually over the course of five years on an initial principal amount of $1,000.

Year	Interest	Amount
1	100.00	1,100.00
2	110.00	1,210.00
3	121.00	1,331.00
4	133.10	1,464,10
5	146.41	1,610.51

We'll now go into a little more detail to show how and when to use each of the eight economic analyses. Let's start off with the simplest one, Compound Amount. As shown in the five year table above, this is the formula to use when you want to compute the future value of a sum of money compounded at a certain rate of interest. As an example, say you have a savings account that claims to pay 8 percent interest, compounded daily. The *periodic* interest rate would be 0.08/365 (days in a year) = .000219178 percent per day. Let's say that at the beginning of the year you had $3,212.78 in this account. Using the Compound Amount formula with: present value P = 3212.78, interest rate i = .000219178, and number of periods n = 365, the program will return a value of $3,480.33, the value of the savings account at the end of the year (see Figure 1). A word of caution is issued here. Not all banks figure interest the *exact* same way. Some use interest rates based on years that have *less* than 365 days—this acts in your favor. Other banks may quote average or historic rates which actually vary daily. Furthermore, your Model 100 works in double precision (unless told to do otherwise) which results in 14 significant digits. Believe it or not, there are many bank computers and interest tables that banks use to figure interest that *are not* as accurate. So beware, your Model 100 can be more accurate than your bank. But be sure you know *how* your bank is figuring your interest before you accuse them of short-changing you. Believe me—I've done it—they'll listen to you, and change things if you're right; just be sure you know what you're doing.

Now for the next analysis, Series Compounding Amount. The best example I can think of to illustrate this formula is the famous bank Xmas Club Account. Say for example, you pay $100 a month into such an account and the bank claims it is paying 6 percent annually, compounded monthly. In this case, you would use an end-of-period payment A of 100, 12 periods n and an interest rate i of .06/12 = 0.005; plugging this into your Model 100 should yield (see Figure 2) an amount at the end of the year of $1,233.56.

Our next example is the Sinking Fund. Here's where you get to use your imagination a little bit to play with the real power offered by your Model 100. Say you have an ambitious dream (don't we all): you want to buy a house, and you figure that in order to make the down payment five years from now, you would like to have $25,000. You also figure that your money will be able to earn for you 8 percent per year (after taxes). Using the sinking fund analysis (#3), just enter 25000 for the future amount F, .08 for the interest rate i, and 5 for the number of periods n; your Model 100 will instantly respond with a figure of $4,261.41 (see Figure 3); this is amount you would have to save annually over the five years (at 8 percent interest) to have $25,000.

The Capital Recovery formula is used to determine the actual *periodic* cost of something over a given period of time. Say, for example, you are given the option to rent office furniture for $250 per month, or you buy it now for $10,000 knowing in the latter case that the furniture will only last five years, after which you would have to replace it. Assume that the $250/month rental contract is also for a five-year period and that interest rates during this time are expected to average 12 percent, compounded monthly; should you buy or rent? Aha, enter the capital recovery formula. You know what your monthly cost will be if you rent the furniture—$250; but what will it *really* cost, including the lost interest, if you plop down $10,000 now? In this example we are assuming that the furniture—after five years—will have no value (if you buy it), and that the rental company will not offer you a nice deal to purchase five-year-old furniture from them at a discount. Using $10,000 for the present value P, 60 (five years times 12 months/

"The Present Worth" formula is a simple, yet useful, tool. Given an amount of money sometime in the future, this formula lets you know the true value of the present time.

year) for the number of periods n and .12/12 = .01 for the interest rate i, the formula yields a figure of $222.44 per month (see Figure 4). This would indicate that purchasing the furniture now (assuming interest rates stay constant) would be the smarter buy.

The Present Worth formula is a simple, yet useful, tool. Given an amount of money sometime in the future, this formula lets you know the true value of the present time. Say you wanted to have $2,000 in a savings account at the end of four years and 7.5 percent interest was paid annually, how much should you put into the savings account now to have the $2,000 four years from now? To compute this, use a future value F of 2000, number of periods n of 4, and an interest rate i of .075; this will yield a value of $1,497.60 (see Figure 5).

As an example of Series Present Worth, let's say you want to buy the love-of-your-life a diamond ring, and you can't decide whether to pay $1,500 now, or $100 a month for 20 months, knowing that if you pay monthly you can put the rest of the money in the bank at 12 percent interest compounded monthly. Here, the period payment A is 100, the number of periods n is 20, and the periodic interest rate i is .12/12 = .01; using these figures, the present value of the money is $1,804.56 (see Figure 6). In this case, you would be much better off paying the $1,500 today as its value is less than the present value of the 20 monthly payments. If, on the other hand, you were offered the chance to make 24 payments of $70 each, you would be better off making the monthly payments since the present worth of those payments would be only $1,487.04!

The remaining two formulas, Gradient Present Worth and Gradient Uniform Series are economic analyses used to evaluate situations where the periodic cash flow A is a steadily changing, rather than constant, amount. As an example of Gradient Present Worth, assume that you have just purchased a new car and you estimate that the annual maintenance on the car will follow the schedule below:

Year	Maintenance Cost
1	$150
2	225
3	300
4	375
5	450

Being alert, cunning, sly, swift and perceptive, you want to prepare for the future by placing a sum of money in the bank now which, with annual interest compounding at 7 percent per year, will pay for the first five years' maintenance. The cash flow in the table above can be broken down into two components, a fixed $150 each year, plus a uniformly increasing amount of $75 per year. This concept is illustrated below:

Year	Fixed Cost	Increasing Cost
1	$150	$ 0
2	150	75
3	150	150
4	150	225
5	150	300

Using the Series Present Worth analysis already described, we can compute the amount needed to be (A=150, n=5, i=.07) which yields $615.03. For the increasing cost portion, we need to use the Gradient Present Worth formula with G=75, n=5, i=.07; this gives a value of $573.50 (see Figure 7). This means you would have to put away $1,188.53 today to be able to withdraw the necessary funds over the next five years to pay for your maintenance.

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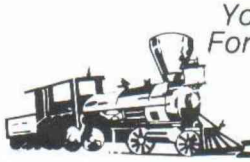

Track 29

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The Gradient Uniform Series is used to determine the annual (or periodic) cost (or benefit) of an item which has a cost (or savings) that *decreases* uniformly over time. The following example illustrates this concept. You are confronted with the following situation: you need to install additional insulation in your house to reduce energy consumption and you figure that no matter what kind of material you use, it will last ten years. You can purchase insulating material *X* or insulating material *Y*, and each will cost the same to purchase. Material *X* will result in energy savings of $420 per year. Material *Y* is strange; it will save you $400 the first year, but each year it will reduce the savings by $40. Which should you choose, taking into account that interest rates are expected to be 12 percent over the next ten years? Well, material *X* will save you $240 per year, that's obvious. To determine the annualized savings from material *Y*, we use the Gradient Uniform Series where the gradient *G* is 40, n=10, and i=.12; this gives $143.39 (see Figure 8) and represents the reduced savings year after year. Therefore, the annualized benefits of material *Y* are $400-143.39 = $256.61, which is less than the $240 that will be saved using material *X*, so you would choose to use material *Y*.

"Depending on your needs, you will probably find several (if not all) of the above economic analyses useful in planning both your day-to-day money matters as well as your financial future."

Depending on your needs, you will probably find several (if not all) of the above economic analyses useful in planning both your day-to-day money matters as well as your financial future. In this ever-changing world of interest rates and banking regulations, these formulas should help in deciding how to make the most of your money.

```
        Select Economic Analysis:

1-Compound Amount    5-Present Worth
2-Series Cmpd. Amt.  6-Series Pres. Worth
3-Sinking Fund       7-Grad Present Worth
4-Capital Recovery   8-Grad Unif. Series
```

Figure 1 COMPOUND AMOUNT

```
Present Value: 3212.78
Interest Rate: .000219178
Number of Periods: 365
Future Value = $3,480.33
```

Figure 2 SERIES COMPOUND AMOUNT

```
Periodic Payment / Receipt: 100.00
Interest Rate: .005
Number of Periods: 12
Future Value = $1,233.56
```

Figure 3 SINKING FUND

```
Future Value: 25000.00
Interest Rate: .08
Number of Periods: 5
Periodic Amount = $4,261.41
```

Figure 4 CAPITAL RECOVERY

```
Present Value: 10000.00
Interest Rate: .01
Number of Periods: 60
Periodic Amount = $ 222.44
```

Figure 5 PRESENT WORTH

```
Future Value: 2000.00
Interest Rate: .075
Number of Periods: 4
Present Value = $1,497.60
```

Figure 6 SERIES PRESENT WORTH

```
Periodic Payment / Receipt: 100.00
Interest Rate: .01
Number of Periods: 20
Present Value = $1,804.56
```

Figure 7 GRADIENT PRESENT WORTH

```
Uniform Arithmetic Gradient: 75
Interest Rate: .07
Number of Periods: 5
Present Value = $ 573.50
```

Figure 8 GRADIENT UNIFORM SERIES

```
Uniform Arithmetic Gradient: 40
Interest Rate: .12
Number of Periods: 10
Uniform Arithmetic Gradient = $143.39
```

The listing:

```
10 CLEAR 100:DEFINT I-N
25 DATA"Compound Amount","Series Cmpd. A
mt.","Sinking Fund","Capital Recovery","
Present Worth","Series Pres. Worth","Gra
d Present Worth","Grad Unif. Series"
35 FOR I=1 TO 8:READ A$(I):NEXT I:GOTO 3
9
37 PRINT@285,"Press any key to continue
... ";:A$=INPUT$(1)
39 CLS:PRINT@8,"Select Economic Analysis
:"
40 FOR I=1 TO 8:PRINT@40+40*I+140*(I>4),
USING"#";I;:PRINT"-";A$(I);:NEXT I
45 PRINT@291,"Press "CHR$(27)"p ESC "CHR
```

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```
$(27)"q to end";
50 PRINT@33,"";:A$=INPUT$(1):IF A$="" TH
EN 50 ELSE IF ASC(A$)=27 THEN MENU ELSE
C=VAL(A$):IF C<1 OR C>8 THEN 50 ELSE 90
52 PRINT@80,"Present Value: ";:LINEINPUT
A$:P=VAL(A$):IF P<=0 THEN 52 ELSE 70
53 PRINT@80,"Future Value: ";:LINEINPUT
A$:F=VAL(A$):IF F<=0 THEN 53 ELSE 70
54 PRINT@80,"Periodic Payment / Receipt:
 ";:LINEINPUT A$:A=VAL(A$):IF A<=0 THEN
54 ELSE 70
55 PRINT@80,"Uniform Arithmetic Gradient
: ";:LINEINPUT A$:G=VAL(A$):IF G<=0 THEN
 55 ELSE 70
62 X=P:GOSUB 80:PRINT@200,"Present Value
 = ";USING F$;P:GOTO 37
63 X=F:GOSUB 80:PRINT@200,"Future Value
= ";USING F$;F:GOTO 37
64 X=A:GOSUB 80:PRINT@200,"Periodic Amou
nt = ";USING F$;A:GOTO 37
65 X=A:GOSUB 80:PRINT@200,"Uniform Arith
metic Gradient = ";USING F$;A:GOTO 37
70 PRINT@120,"Interest Rate: ";:LINEINPU
T A$:X=VAL(A$):IF X<=0 OR X>40 THEN 70
71 PRINT@160,"Number of Periods: ";:LINE
INPUT A$:N=VAL(A$):IF N<1 OR N>480 THEN
71
72 RETURN
80 N=LOG(X)/LOG(10)+1
81 IF X>1E6 THEN N=N+1
82 F$="$"+STRING$(N,"#")+",.##":RETURN
90 CLS:ON C GOTO 100,400,300,500,200,600
,800,700
100 PRINT@12,"COMPOUND AMOUNT"
110 GOSUB 52
120 F=P*(1+X)^N:GOTO 63
200 PRINT@13,"PRESENT WORTH"
210 GOSUB 53
220 P=F*(1+X)^(-N):GOTO 62
300 PRINT@14,"SINKING FUND"
310 GOSUB 53
320 A=F*(X/((1+X)^N-1)):GOTO 64
400 PRINT@9,"SERIES COMPOUND AMOUNT"
410 GOSUB 54
420 F=A*(((1+X)^N-1)/X):GOTO 63
500 PRINT@12,"CAPITAL RECOVERY"
510 GOSUB 52
520 A=P*(X*(1+X)^N/((1+X)^N-1)):GOTO 64
600 PRINT@10,"SERIES PRESENT WORTH"
610 GOSUB 54
620 P=A*(((1+X)^N-1)/(X*(1+X)^N)):GOTO 6
2
700 PRINT@8,"GRADIENT UNIFORM SERIES"
710 GOSUB 55
720 A=G*(1/X-(N/((1+X)^N-1))):GOTO 65
800 PRINT@9,"GRADIENT PRESENT WORTH"
810 GOSUB 55
820 P=G/X*(((1+X)^N-1)/X-N)*(1/(1+X)^N):
GOTO 62
900 P=IR*40+IC:RETURN
```

PCM

SOFTWARE

BUSINESSPAK+ Totally Professional Package

Last month we reviewed three excellent programs for the Model 100 from the Portable Computer Support Group. Six programs comprise a truly "professional" package for business-oriented users called BUSINESSPAK+. The first three programs were *WRITE+*, a print formatter, *PUT+*, a mini-database and *SORT+*, a quick sorting routine. This month we will take a look at *EXPNS+*, *GRAPH+* and *TELEX+*.

EXPNS+

As the name implies, *EXPNS+* is a miniature version of *Visi-Calc* tailored for expense reports and small budgets. The limits of this spreadsheet are 18 rows and 12 columns. Amounts up to $99,999.00 are accepted. Even H. L. Hunt can use this one. At the same time it is suggested if this figure is too small dropping three zeros would put you in the standard business reporting format. Five digits was more than adequate for my last five-day trip to Mehoppany, Pa.

Two canned "shells" are provided for expenses and budgets. The user has full editing capability to name the rows and columns per his own wishes. After the main program and the "shell" are loaded the screen is formatted with prompts for title information. Nine titles are accepted. After completing this formality you are ready for the traveler's nightmare, the actual data for your expenses. The thing that makes this program outstanding is that calculations are made for you, and any input errors are remedied without heavy erasing. All you do is edit the column and the totals are updated.

GRAPH+

Imagine the boss, or personnel manager, when he sees your next expense report complete with a pie chart. Now you know what *GRAPH+* is all about. Using the data file you developed earlier in *EXPNS+* you can now generate a pie, bar or line chart for any row or column of your spreadsheet. I prefer the pie chart format. A 3" circle is divided into up to 18 categories. Each division is listed both in a summary at the bottom of the page and adjacent to its portion of the chart. Very impressive, to say the least. Output is formatted for a DMP 100 dot matrix printer. No mention is made of the adaptability of other printers.

TELEX+

Your Model 100 is also an electronic mailbox. With *TELEX+* you can send a text file to any telex machine in the world or send an ECOM, electronic mailgram, to any mail address. Sending a Telex is very simple. After loading the program, and connecting your modem, you place the cursor over *TELEX+*, and as quick as you can say "Western Union" a prompt appears asking "Which doc-

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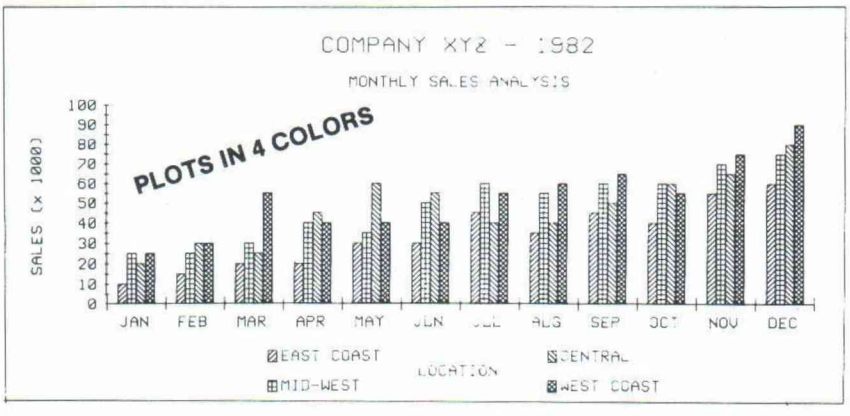

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ument to send?" A preformatted Telex is then sent to any point in the world.

Instructions are given for registration with Action Telex. A $150 per year fee is required to use this service but I'm sure it's worthwhile if your business warrants the use of Telex. Due to this fee I didn't try this feature, even though PSCG will give you a temporary code for up to three messages at no cost.

Summary

As I mentioned last month the documentation is excellent. Step-by-step instructions are supplied with several examples for each program. A direct telephone number is given for general questions. Or, better than that, send them a Telex!

(Portable Computer Support Group, 11035 Harry Hines Blvd., No. 207, Dallas, TX 75229, $89.95, includes manual and six cassettes)

—Dan Downard

SOFTWARE

Frankenstein Adventure Included In Game Pack

Adventures are probably the most adaptable game applications for computers. Imagine yourself in a cemetery opening a secret note from Victor Frankenstein reading "As my last living relative you are entrusted with a great mission." Sounds interesting already.

Frankenstein Adventure is one of the four programs offered by SilverWare as part of a game package also containing *Reversi, Blockade* and *Alexis Adventure*. The games range in memory requirements from 6.5K to 18.5K. If you haven't noticed, the amount of available memory is listed below the BASIC sign-on message. *Frankenstein Adventure* requires 15K as it is a BASIC program and loaded using CLOAD. Instructions are included for storing the program in memory for quicker recall.

Cemetery gates, mansions and tombstones seem to be the theme of this adventure. What would you expect from Frankenstein? Commands can be abbreviated by the use of a single key such as "N" to go North. All input has to be in upper case. I played the game several times. Once I died in quicksand, while another time I was left wandering in a mansion looking for clues to the puzzle. The program gave adequate response to my input and was interesting to play. No graphics were encountered.

I would recommend *Frankenstein Adventure* to anyone who enjoys adventure games, and as a diverse addition to the game pack. Have fun—and please tell us what you find in the library.

(Siverware, P.O. Box 21101, Santa Barbara, CA 93121, tape $24.95)

—Pat Downard

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